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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/559,757	04/27/2000	Yoshio Ozawa	04329.2306	2923

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EXAMINER

PHAM, THANH V

ART UNIT PAPER NUMBER

2823

DATE MAILED: 08/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/559,757

Applicant(s)

OZAWA ET AL.

Examiner

Thanh V Pham

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8-19 is/are pending in the application.
- 4a) Of the above claim(s) 16-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/29/04, 6/22/04
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/22/04 has been entered.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Response to Amendment

3. Applicant's arguments with respect to claims 8-15 have been considered but are moot in view of the new ground(s) of rejection.

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Art Unit: 2823

5. Claims 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicants' admitted prior art in combination with Hisamune US Patent No 6,414,352 B1 and Aminzadeh et al. US Patent No 6,707,120 B1.

In the description of the prior art of fig. 15, the applicants disclose that an insulating film containing silicon and nitrogen 95 is formed on the substrate 91; a film which must be processed and which contains silicon 93 is formed on the insulating film; those films are processed such that a portion of the insulating film is exposed to the outside; the structure obtained in the previous steps is subjected to an oxidation process.

The applicants' admitted prior art does not provide, in the oxidation step, oxidizing gas containing one of ozone and oxygen radicals.

The Hisamune reference discloses oxidation processes are required after forming the gates and recognizes that, in the conventional oxidation processes, oxygen radical created within a furnace easily diverges through the separating regions in the form of silicon dioxide and reaches the gates. This encroachment of the oxide into the bottom of the gates is known as a "gate bird's beak" because of its shape when viewed in cross-section (col. 2, line 64 to col. 3, line 7).

The applicant's admitted prior art teaches "bird's beak oxidation owing to the post oxidation" (the instant specification, page 20's last line), the Hisamune reference also concerns about the gate bird's beak (col. 1, line 9 and col. 3, line 6). To employ the oxidation process with conventional oxidizing gas containing one of ozone and oxygen radicals of Hisamune to the oxidation process of applicants' admitted prior art would

Art Unit: 2823

have been obvious to one of ordinary skill in the art as the oxidizing gas containing one of ozone and oxygen radicals as recognized as conventional by Hisamune would be selected in order to prevent dielectric failure in insulating layer in accordance with the oxidation step as taught by applicants' admitted prior art.

The combination lacks the step of subjecting the structure to at least one of a nitriding process and an additional oxidation process. "Improvement in the quality of the film owing to recovery of the process damage becomes insufficient" (applicant's admitted prior art, page 21, lines 20-22).

The Aminzadeh et al. reference discloses a process of Kusunoki et al. in IEEE IEDM, vol. 91, wherein the re-oxidized nitrided oxide applied on the gate structure could increase the thickness of side oxide 201, fig. 2 and last line of col. 1. With its own idea, the Aminzadeh et al. reference discloses "the poly reox step forms oxide 600 on the gate electrode 403, and also increase the thickness of gate oxide 404 over the areas that will become the source and drain regions", col. 3, last line to col. 4, line 2. The "oxide 600 is then nitridated to strengthen the oxide", "the nitridation can be performed in a furnace or a RTP", col. 4, lines 22 and 34-35. The gate structure is subjected to the oxidizing process to at least one of nitriding process and an additional oxidation process as in fig. 7 and the related explanation in col. 4, line 42 to col. 6, line 30.

"Lowering a surface of the semiconductor substrate under a part of the insulating film than a surface of the semiconductor substrate under the film which is processed to cause the portion of the insulating film to be exposed to the outside by applying a thermal oxidation process to a semiconductor structure obtained in the step of an

Art Unit: 2823

oxidation process by using the oxidizing gas containing one of ozone and oxygen radicals” is inherent as recognized by Aminzadeh et al.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply further the nitridation and anneal steps of Aminzadeh et al. into the above combination of Hisamune with applicants' admitted prior art as a further process step would be selected in order to strengthened the gate dielectric film in accordance with the oxidation step as taught by Aminzadeh et al.

The concentration of $5 \times 10^{13} \text{ cm}^{-2}$ nitrogen in the interface of silicon oxynitride film with the silicon substrate would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose this particular concentration to overcome applicants' admitted prior art constraint (specification's page 21), and it appears that the process would possess utility using this concentration.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh V. Pham whose telephone number is 571-272-1866. The examiner can normally be reached on M-T (6:30-5:00).


Art Unit: 2823

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TP

TvP
07/27/04


George Fourson
Primary Examiner